

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
16 June 2005 (16.06.2005)

PCT

(10) International Publication Number
WO 2005/054746 A2

(51) International Patent Classification⁷: **F22B 1/00**

(21) International Application Number:
PCT/US2004/039515

(22) International Filing Date:
24 November 2004 (24.11.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/525,578 26 November 2003 (26.11.2003) US

(71) Applicant (for all designated States except US): **AQUAT-
ECH INTERNATIONAL CORPORATION** [US/US];
One Four Coins Drive, Canonsburg, PA 15317 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MINNICH, Keith,
R.** [US/US]; W291 N3821 Round Hill Circle, Pewaukee,
WI 53072 (US). **NICHOLSON, Mark, C.** [US/US];
W269 N2740 Lelah Avenue, Pewaukee, WI 53072 (US).

KARLAPUDI, RamKumar [IN/US]; 1981 Fox Croft
Lane, Waukesha, WI 53189 (US). **SCHOEN, Richard,
M.** [US/US]; N67 W29767 Hartling Road, Hartland, WI
53029 (US).

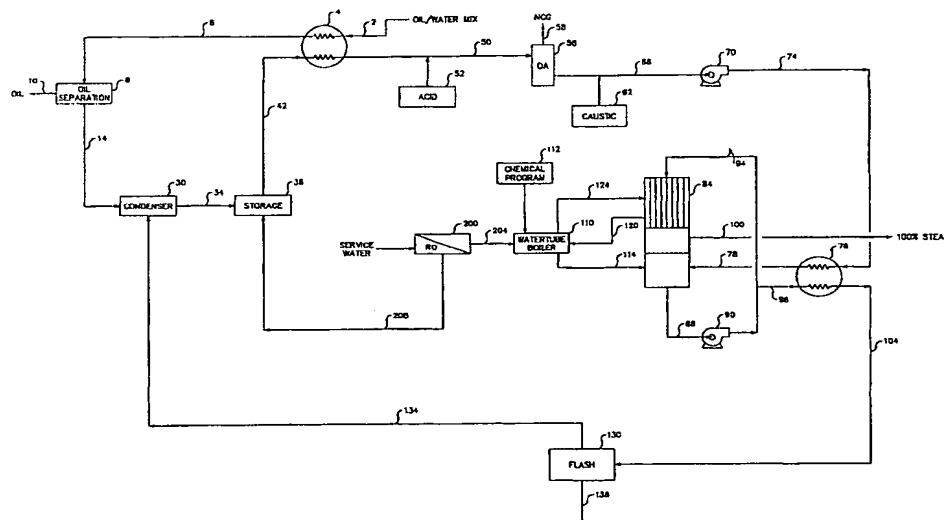
(74) Agent: **WOZNY, Thomas, M.**; Andrus, Sceales, Starke
& Sawall, LLP, 100 East Wisconsin Avenue, Suite 1100,
Milwaukee, WI 53202-4178 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE,

[Continued on next page]

(54) Title: METHOD FOR PRODUCTION OF HIGH PRESSURE STEAM FROM PRODUCED WATER



(57) Abstract: An evaporation based method for generation of high pressure steam from produced water in the heavy oil production industry. De-oiled produced water is processed through a high pH/high pressure evaporator driven by a commercial watertube boiler. The vapor produced by the evaporator is suitable for the steam assisted gravity drainage (SAGD) method being utilized by heavy oil recovery installations, without the use of once through steam generators that require extensive chemical treatment, and without requiring atmospheric distillation, which requires high power consuming compressors. Evaporator blowdown may be further treated in a crystallizing evaporator to provide a zero liquid discharge (ZLD) system and, with most produced waters, at least 98% of the incoming produced water stream can be recovered in the form of high pressure steam.

WO 2005/054746 A2



SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *without international search report and to be republished upon receipt of that report*